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CONTENT BASED IMAGE RETRIEVAL USING WAVELET AND CURVELET BASED TEXTURE FEATURE

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ABSTRACT:

In present research paper an attempt was made to do a comparative study of the two methods for content based image retrieval. The first method is that texture based features are extracted from the wavelet transform and in second method the feature extraction was done using curvelet transform. The aim is to investigate an efficient and effective technique for content based image retrieval from wavelet and curvelet transform. wavelet transform has been explored widely in various branches of image processing, it fails to represent objects containing randomly oriented edges and curves as it is not good at representing line singularities.

In this work, different type of hundred images were collected and stored as the database. Then Color images were converted into gray color by using gray co-occurrence matrix. After that it performs decomposition up to three levels by using discrete wavelet transform and wrapping based discrete curvelet transform and features are extracted. then indexing, similarity matching was done by using Euclidian distance method. Hence, finally project has been demonstrated by using the plotted graphs one for the efficiency and another graph with respect to time of the system. The results obtained demonstrate that the curvelet transform based retrieval are more efficient then wavelet transform based retrieval. The results obtained are in accordance with the expected predictions of the existing theory of curvelet transform.

KEY WORDS: Discrete curvelet transform. wrapping based discrete curvelet transform.

1. INTRODUCTION:

Worldwide networking allows us to communicate, share, and learn information in the global manner. Digital library and multimedia databases are rapidly increasing; so efficient search algorithms need to be developed. Retrieval of image data has traditionally been based on human insertion of some text describing the scene, which can then be used for searching by using keywords based searching methods. This is very time consuming and difficult for describing every color, texture, shape,

and object within the image. We know that an image speaks thousands of word. So instead of manually annotated by text-based keywords, images would be indexed by their own visual contents, such as color, texture and shape, so researchers turned attention to content based retrieval methods.

Curvelet transform has been developed to overcome the limitations of wavelet and Gabor filters. Though wavelet transform has been explored widely in various branches of image processing, it fails to represent objects containing randomly oriented edges and curves as it is not good at representing line singularities. Gabor filters are found to perform better than wavelet transform in representing textures and retrieving images due to its multiple orientation approach. However, due to the loss of spectral information in Gabor filters they cannot effectively represent images. This affects the CBIR performance. Consequently, a more robust mechanism is necessary to improve CBIR performance. To achieve a complete coverage of the spectral domain and to capture more orientation information, curvelet transform has been developed.

2. BRIEF LITERATURE SURVEY

To better understand wavelet and curvelet based image retrieval system, it is beneficial to examine some of the current literature on these topics.

In Paper [1] the author lenina birgale specified that the novel approach combines colour and texture features for content based image retrieval. Features like color and texture are obtained by computing the measure of standard deviation in combination with energy on each color band of image and sub band of wavelet. Wavelet transform is used for decomposing the image into 2x2 sub bands. Feature database in content-based image retrieval of 640 Visual texture (VisTex) color images is constructed. It is observed that proposed method outperforms the other conventional histograms and standard wavelet decomposition techniques. Application of World Wide Web (www) and the internet is increasing exponentially, and with it the amount of digital image data accessible to the users. A huge amount of Image databases are added every minute and so is the need for effective and efficient image retrieval systems.

In Paper [2] The author Manesh kokare discussed that the rapid expansion of the Internet and the wide use of digital data have increased the need for both efficient image database creation and retrieval procedure. The challenge in image retrieval is to develop methods that can capture the important characteristics of an image, which makes it unique, and allow its accurate identification. The focus of this paper is on the image processing aspects that in particular using texture information for retrieval. We present a unique wavelet transform based texture features for content-based image retrieval, which is comparable with standard existing methods. We propose the use of pyramidal and tree structured wavelet features using 8-tap Daubechies coefficients for texture analysis and

provide extensive experimental evaluation. Comparison with various features using Broadtz texture database indicates that the combination of energy and standard deviation of wavelet features provide good pattern retrieval accuracy for tree structured wavelet decomposition while standard deviation alone gives better result in pyramidal wavelet decomposition. In most of the existing retrieval methods the most commonly used Euclidean distance function or measure of dissimilarity between feature vectors is used, but we observed that, it is not always the best metric. We have done the comparison of results using Euclidean distance and Manhattan distance for both the tree structured and pyramidal wavelet decomposition methods and found that Manhattan distance gives better result than Euclidean distance metric.

3. SYSTEM DEVELOPMENT

In the following system design in figure 1, a database of hundred images is created and first each image of the database is decomposed up to three level by using both transformation techniques that is discrete wavelet transform (DWT) and discrete curvelet transform after this texture feature such as mean and standard deviation are extracted for each image and feature vector is created which contains mean values for the database images. Similarity matching is done by using Euclidian distance metric and performance is measured with respect to time and efficiency of the proposed system

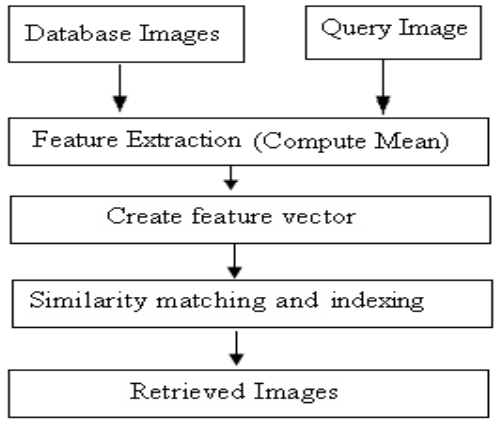

Figure 1. System Design flow

4. PROPOSED METHODOLOGY

In present work a comparative study of wavelet and curvelet transform is performed. Due to the limitations of wavelet transform, the images contain arcs, edges and curves are not sharp. curvelet transform provides a good opportunity to extract more accurate texture features suitable for use in image retrieval. Curvelet transform provides more detailed information of the image in the spectral domain using more orientation information at each scale. Therefore, our main objective is to employ curvelet texture features for content based image retrieval.

4.1. ALGORITHMS

I. *Algorithm for wavelet based texture feature for Content based image retrieval*

- Create database of texture Images
- Take query image
- Decompose images in non-Overlapping Sequence
- Extract the Features From Images
- Find the Matching Features Between Image
- Automatic indexing

- Resulted Images in output

II. *Algorithm for curvelet based texture feature for content based image retrieval*

- Create database of texture Images
- Convert each image into polar image.
- Decompose the image up to four levels by using ridgelet transform.
- Texture Feature extraction.
- Creating the feature vector.
- Accepting the query image.
- Similarity Matching.
- Indexing the resulted images.
- Displaying the resulted images.

4.2. PERFORMANCE EVALUATION METHODS OF CBIR

The level of retrieval accuracy achieved by a system is important to establish its performance. If the outcome is satisfactory and promising, it can be used as a standard in future research works. In CBIR, precision-recall is the most widely used measurement method to evaluate the retrieval accuracy. We have found some recent literature use this pair to measure the retrieval performance. Precision P is defined as the ratio of the number of retrieved relevant images r to the total number of retrieved images n , i.e p=r/n. Precision measures the accuracy of the retrieval.

$$p = \frac{No\ of\ Relevant\ Images\ Retrieved}{Total\ No.of\ Images\ Retrieved}$$

Recall is defined by R and is defined as the ratio of the number of retrieved relevant Images r to the total number m of relevant images in the whole database, i.e., R=r/m. Recall measures the robustness of the retrieval. Recall is defined by R and is defined as the ratio of the number of retrieved relevant Images r to the total number m of relevant images in the whole database, i.e., R=r/m [1].

$$p = \frac{No\ of\ Relevant\ Images\ Retrieved}{Total\ No.of\ Images\ Retrieved\ in\ db} = \frac{t}{m}$$

Generally, precision values fall with increases in the recall values. A retrieval system can be called 'ideal' if both the precision and recall values remain high. However, in reality, no such image retrieval system has yet been found. Precision-recall pair is a good standard of performance evaluation. It provides meaningful result when the database type is known and has been effectively used in some earlier research. For other data sets, especially those which have been created by collecting user generated images, the result may vary due to different human concepts of image classification.

5. EXPERIMENTATION

The experimentation is mainly for the comparative study over the database of hundred varied sized images from which the set of test images was created which are as follows.

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5.1. PERFORMANCE ANALYSIS

We compare the wavelet texture retrieval result with the Curvelet texture features with respect to distance and efficiency of the system. In the table 1 there is set of 10 test images which show the different results. For the first query image we obtained the distance and efficiency which differs in case of Curvelet transform for the same query image.

Table1. Results for the set of test images using wavelet transform

Sr. No	Images	Distances	Efficiency
1	Image1	4.9921	79.31
2	Image2	5.4512	86.20
3	Image3	5.3605	65.51
4	Image4	5.2241	6.89
5	Image5	5.2371	6.89
6	Image6	5.2046	82.0
7	Image7	5.3434	89.0
8	Image8	5.2969	10.0
9	Image9	5.3352	31.0
10	Image10	5.3871	65.0

5.2. EFFICIENCY

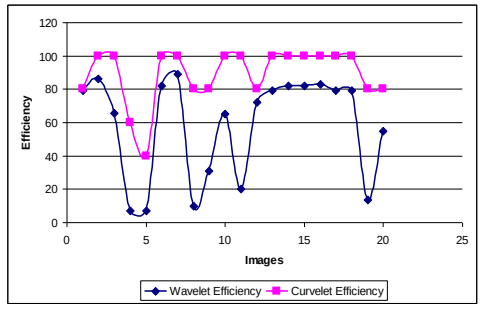
For the efficiency of the system is if the resultant image and original image's mean square error is less then 0.25 then we can say that it's a perfect match or one otherwise zero. For indexing the resultant images we are using the threshold value of 95 percent for accuracy and on the basis of these criteria we can plot the first five exact matches. For Curvelet transform system we have given the same set of images as given for wavelet system and the differences in the results can be observed from the Table 2.

Table2. Results for the set of test images using curvelet transform

Sr. No	Images	Distance	efficiency
1	Image1	0	80
2	Image2	0	100
3	Image3	0	100
4	Image4	0	60
5	Image5	0	40
6	Image6	0	100
7	Image7	0	100
8	Image8	0	80
9	Image9	0	80
10	Image10	0	100

5.3. GRAPH

The following graph (a) is plotted on the basis of the number of images and efficiency obtained after retrieval of each image from set of test images which is shown in Table 1 and Table 2. Where the x axis shows the number of images and y axis denotes the efficiency of the system. From the graph we can observe that the curvelet transform is more efficient then the curvelet transform



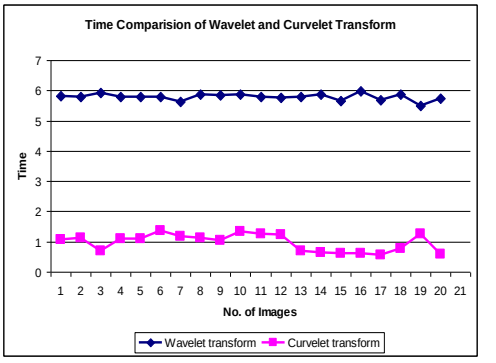
Graph a. Graph with respect to efficiency of the system.

Table3. Image retrieval analysis for both transforms techniques with respect to time

Sr. No	Images	Wavelet transform	Curvelet transform
1	Image1	5.820	1.0666
2	Image2	5.788	1.1212
3	Image3	5.916	0.6929
4	Image4	5.799	1.0900
5	Image5	5.790	1.1110
6	Image6	5.8013	1.3642
7	Image7	5.6372	1.1703
8	Image8	5.8757	1.1270
9	Image9	5.8353	1.0540
10	Image10	5.8857	1.3534

The Table 3 shows the time comparison for wavelet based and curvelet based system. For this time evaluation we have used the matlab function called tic toc which gives the total elapsed time to retrieve an image. The table shows the elapsed time for the same set of test images.

The following graph (b) shows the time comparison for wavelet based and curvelet based system. which is plotted on the basis of set of test images Vs time required for retrieving an image from the graph we can observe that the time required for curvlet system is less than the time required by the wavelet system. The graph is plotted on the basis of the values obtained from the table 3.



Graph b. Time comparison for wavelet based and curvelet based system

6. CONCLUSION AND FUTURE WORK

Discrete Curvelet transform has a powerful capability of representing the edge curves in an image. As compared to the methods of wavelet transform. The wrapping based discrete curvelet transform has been found to be the most effective and efficient. Therefore, we choose it to represent the image textures in this project. Result images displayed using GUI which gives exact images or similar images. And retrieval accuracy is improved using Euclidean distance than the man hat tan distance of texture feature for CBIR.

Speed is calculated using time required to execute the program it also gives less time. Retrieval accuracy is improved using curvelet transform. During the implementation, we also proved that by considering object uniqueness during similarity distance computation improve the accuracy during retrieval.

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